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Sustainability and multifunctionality of protected designations of origin of olive oil in Spain

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ABSTRACT

Agrarian systems provide sociocultural and environmental externalities, which contribute to the sustainability of rural areas. The aim of this article is to analyse the sustainability of some Spanish olive oil Protected Designations of Origin (PDO) through multicriteria techniques (Analytical Network Process), taking into consideration different farming systems. The analysis has been made through ten criteria grouped in three clusters: economic, environmental and socio-cultural and asked experts. This was done first to rank the criteria and second in terms of what type of farming system achieves these criteria better. According to the results, there is a high level of consensus regarding the criteria ranking and the way that farming systems contribute to agrarian multifunctionality and sustainable development, despite the different characteristics of PDOs. In all cases, organic farming is the best, followed by integrated farming, when achieving economic, environmental and socio-cultural criteria, except for Estepa (where integrated farming is preferred for the economic and socio-cultural criteria). Conventional farming is placed in third position when achieving all functions, except for the environmental criteria, for which abandonment is preferred to conventional farming in all PDOs. Multifunctionality and sustainability are maximized by a combination of farming systems: about 40% organic, 35% integrated, 20% conventional and 5% crop abandonment.

The results of our model regarding the combination of farming systems are similar to the actual situation in the PDOs studied, and, more important, this has been achieved thanks to the PDO institutions. Good local institutions contribute to improve the sustainability of rural areas by encouraging innovation and entrepreneurship (especially in PDOs, triggered by Origin Designation Regulator Councils) and **a** European level, by paying farmers for externalities.

1. Introduction

Agrarian activities provide raw materials and food but also a broad range of positive social and environmental externalities, which contribute to the sustainability of rural areas. By "agrarian multifunctionality" we mean the ability to create a wide variety of outputs, such as externalities and public goods. This term was coined by the European Union at the end of the 1990s and refers to three functions: (a) agrarian production, (b) the preservation of rural areas and their landscapes and (c) the contribution to the social feasibility of rural areas.

The cultivation of olive groves, which exceeds 2.5 million ha in Spain, is important not only from an agrarian perspective but also in regards to the regional landscape, natural and cultural heritage and environmental management. Therefore, olive farming provides a potentially suitable study-case to analyse the multifunctional behaviour of agricultural systems. However, little work has been done on the sustainability of olive oil qualified by Protected Designations of Origin (PDO), the agencies that certify the highest quality olive oil in the EU. Additionally, although there are no previous studies comparing the situation of other geographical areas in Spain outside Andalusia, the national leading producer of olive oil, initial observation suggest differences in economic, environmental and social characteristics across regions.

The aim of this article is to analyse the sustainability of some Spanish olive oil PDO through multicriteria techniques and by taking into consideration different farming systems.

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Quite possibly, olive oil producers are not aware of the positive externalities they generate. In this article, we argue that the economic profitability (from a social perspective) of olive oil production under a PDO is higher than the financial profitability (from a private perspective). For this, we have used the analytic network process (ANP) and tested some methodological variations in terms of a number of Spanish olive oil PDOs. As a result, the generation of externalities by different farming options (organic, integrated, conventional and abandonment) is analysed.

A series of articles on this topic have been written in the last few years with different methodological approaches. In this regard, Kallas et al. (2006), Kallas and Gómez-Limón (2007), Gómez-Limón et al. (2007), Arriaza et al. (2008) and Gómez-Limón and Barreiro (2012) analyse characteristics of olive groves by applying the choice experiment methodology. With this methodology, Villanueva et al. (2015a) design tools to promote agricultural public goods production. Others, like Marangon et al. (2008), evaluate the landscape composed of hillside olive groves in the Slovenian region of Goriska Brda applying the contingent valuation method. Fleskens et al. (2009) value the role played by the functions of agricultural olive grove ecosystems to plan accordingly in the hills of northeastern Portugal. Meanwhile, Gómez-Limón and Riesgo (2012) propose a set of multifunctional representative indicators to analyse the sustainability of various Andalusian olive grove zones.

By means of the analytic hierarchy process (AHP), Parra-López et al. (2005, 2007, 2008) and Villanueva et al. (2014a,b) address externalities and public goods generation in different olive grove systems and for different farming decisions and structural features. They analyse the economic, technical, sociocultural and environmental functions of olive groves. The same methodological framework is applied by Gómez-Limón and Arriaza (2013) to analyse the social preferences of different features of Andalusian rural areas. Arriaza and Nekhay (2010) combine the AHP tools and its generalization, the ANP, and apply them to Andalusian poorer olive oil producing groves. Carmona-Torres et al. (2011), Pérez y Pérez et al. (2013), Carmona-Torres et al. (2014) and Villanueva et al. (2014b) have all used the same methodology to analyse the sustainability of good agricultural practices, the productive systems in different territorial areas and the influence of management factors in the production of public goods of Andalusian olive groves. Villanueva et al. (2015b) discuss the contribution of relevant economic actors to the provision of private and public goods in three European agricultural landscapes.

From the works quoted above, it can be concluded that, in Andalusia, the relationship between productive activity, sustainability and the generation of positive externalities depends on farming practices, the physical and territorial features of olive groves and different types of cultivation. From a methodological point of view, it is acknowledged that other conclusions could be derived, especially if additional regions, farming systems or olive oil PDO producing areas were considered. It is apparent that more empirical research, applying different methodological frameworks and available analytical techniques, is needed to deepen the understanding of the impact on sustainability of different olive oil grove systems in different Spanish regions.

2. Case study

Spain occupies first place in the world ranking of olive grove and olive oil production, representing 45% of world production and 60% of European Union (EU) production. In 2014, the area devoted to this crop was 2,515,751 ha, of which approximately 72% was grown on dry land. The average production in the last six harvests exceeded 1.2 million t (Magrama, several years, 2016). It is worth highlighting that, during the past decade and despite the progressive reduction of the cultivated area, average production increased by 23%, mainly due to the rise of superintensive irrigated farms.

Of the 2.5 million ha of Spanish olive groves, 688,245 are registered by the 28 olive oil PDOs existing in Spain. The food quality certification under PDO is established by EU regulation and ensures some quality requirements that are higher than those required for other food products. Foods covered by PDO are those whose quality and characteristics are due to the geographical environment, with its natural or human factors. Their production and processing are always carried out in the delimited geographical area that gives them their name.

The empirical analysis has been applied to four different olive oil PDOs: Estepa, Sierra Mágina and Sierra de Segura in the Andalusian region (South of Spain) and Bajo Aragón (northeastern Spain). According to Magrama (2015), these four PDOs represents 156,710 ha of olive groves (22.8% of the area of olive groves in Spain) and host 103 oil mills (28% of the total). They certify and sell around a quarter of all Spanish olive oil under PDOs for an amount that exceeded € 34.6 million in 2014 (Table 1).

These PDOs have different agronomic, economic, environmental and social features. For instance, Sierra de Segura and Sierra Mágina have farms with steep slopes, typical of mountain olive groves, with very limited possibilities for mechanization and medium and low yields per ha. By contrast, the landscapes in Aragón and Estepa correspond more with the countryside and the rolling hills of lower altitudes. While in Estepa, minor mechanization and lack of irrigation hamper olive yields, in Aragón, a harsh climate, with little chance of irrigation, and the low productivity of traditional local olives pose a threat to the survival of the olive groves that in fact are gradually being abandoned.

Similarly, the greater potential for irrigation of olive farms and varieties of highly productive local olive in Andalusian PDOs makes average farm productivities much higher than those observed in Bajo Aragón. This is due to the spread of native varieties with very low yields in dry lands. Finally, most of the economic activity in the mountains of Sierra de Segura and Sierra Mágina revolves around the olive groves, which are by far the most important in both PDOs. However, in Bajo Aragón and Estepa, the economy is much more diversified among other agricultural, industrial and service branches, and, therefore, the economy in both PDOs is not as dependent on olive-growing activity.

Moreover, as the relationship between olive grove production and the generation of externalities depends on the type of farming system, we analyse the provision of externalities in PDOs offered by each farming system: organic, integrated, conventional and abandonment.

The organic farming system is the most respectful of the environment and also provides the most positive externalities for society. Nevertheless, the share of this farming system in Spanish olive oil PDOs is still very limited, except for in Sierra de Segura.

The integrated system is a farming model that minimizes the use of agrochemicals and seeks maximum food safety. This system is particularly widespread in the whole of Andalusian agriculture. Integrated Andalusian olive groves occupy almost 400,000 ha; this system is more environmentally friendly than conventional agriculture and obtains higher yields per ha than organic farming. Estepa is a good example of an Andalusian olive oil PDO where the integrated system is clearly predominant.

The conventional or traditional farming system is one that, based on a high consumption of agrochemicals, aims to ensure and maximize its financial feasibility, regardless of its negative effects on the environment. In Bajo Aragón, this production system is the most representative, having a limited presence of organic and integrated systems in this PDO.

Finally the abandonment of olive groves has also been considered in the analysis. Although it is not strictly a production system,